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(54) IMPROVEMENTS IN OR RELATING TO OPERATORS FOR LIFT DOORS

(71) We, WM. WADSWORTH & SONS LIMITED, a British Company of High Street, Bolton, BL3 6SS, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to operators for lift doors. Such operators are usually mounted on the lift car and when the car is at a landing the car doors are coupled to the landing doors for operation therewith.

Generally, lift door operators are energised by electric motors, which after suitable speed reduction, are coupled to a crank which drives a lever arrangement connected to the door or doors to be operated. The crank rotation moves the doors with velocity/time characteristic which is sinusoidal. Such an arrangement meets the demand for a period of acceleration and deceleration away from and towards the limits of the door travel. However, it also provides a velocity peak intermediate the limits of travel and with fast operating doors the kinetic energy of the doors can be quite high causing some apprehension when viewing safety requirements.

An object of the invention is to provide an improved lift door operator enabling the peak kinetic energy of the doors for a given operating time to be reduced compared with the sinusoidal type operators and yet providing periods of acceleration and deceleration at the door travel limits.

According to the invention, a lift door operator comprises a pair of spaced apart wheels around which a chain or like band extends, the chain or band having a run extending directly between the wheels, drive means for moving the chain or band to and fro on the wheels, a driving arm for opening and closing a lift door con-

nected thereto, the driving arm being connected at a point of attachment on said run to the chain or band, the spacing of the wheels and the movement of the chain or band being such that the point of attachment of the driving arm to the chain or band passes partially round the wheels to provide periods of acceleration and deceleration and between the wheels to provide a substantially constant velocity movement between the acceleration and deceleration periods.

Conveniently, an endless chain is used which is arranged to pass over a driving sprocket arrangement coupled to a torque motor. Limit switches are provided at the extremities of movement, the switches being included in the motor control circuit.

An embodiment of the invention will now be described with reference by way of example to the accompanying drawing, which is a schematic side view of a door operator in accordance with the invention.

Supported on the top of a lift car is a back plate 1 on which is mounted a torque motor 2 with a pulley 3 driving a pulley 4 through a belt 5. Pulley 4 is journaled in back plate 1 and is coupled with a driving sprocket 6 for an endless chain 7 which passes under spring loaded jockey sprockets 8 and around chain wheels 9 and 10, there being a straight run 11 of chain between the lower parts of chain wheels 9 and 10. By controlling the motor 2 the chain may be moved in one direction or the other.

Attached to an anchorage 12 on the chain run 11 is one end of a driving arm 13 which at its other end is pivotally mounted to a bracket 14 carried on a lift car door 15. To close door 15 the anchorage 12 is carried to the left by the chain 7 and to open the door anchorage 12 is carried to the right. Chain 7 is moved with a substantially constant linear speed and therefore the speed of the door anchorage 12 between the

wheels 9 and 10 and the speed of the door will be substantially constant, i.e. the speed does not peak as with a sinusoidal system.

To provide the acceleration and deceleration periods at the extremities of movement of the door, the door anchorage 12 is arranged to pass with the chain around approximately a quarter sector of wheels 9 and 10. As the door opens, the door anchorage 12 moves to the right and, when the anchorage reaches the wheel 10, it picks up an actuator arm 16 for a limit switch 17. The door anchorage 12 follows wheel 10 for approximately a quarter turn before limit switch 17 is actuated and motor 2 cut-off. This movement around wheel 10 provides a period of deceleration as far as movement of the door is concerned although not as far as the chain is concerned.

When the door is to close, motor 2 is started and chain 7 moves in a clockwise direction carrying the door anchorage 12 with it. The door goes through a period of acceleration and then constant velocity until the door anchorage 12 reaches the wheel 9 and a period of deceleration commences. At this point, the door anchorage 12 picks up an actuator arm 18 which has the two fold function of operation a limit switch 19 and of compressing a resilient means in the form of a spring 20 through a radial extension or arm 21. As the door anchorage 12 passes round wheel 9 so arm 21 compresses the spring 20 until a stop 22 is reached by arm 18 and/or the door anchorage 12, whereupon limit switch 19 is operated and the motor 2 is switched to a low voltage which maintains a tension in chain 7 to hold the door anchorage and/or actuator arm 18 against stop 22. The car door is thus held closed and the lock on the landing door enabled to engage to lock it. Should the power supply to the lift fail, the torque supplied by motor 2 will cease and spring 20 will move the door via arms 21 and 18 sufficiently to facilitate a finger grip to be obtained for manual operation. If the car is at a landing the movement of the car door is sufficient to release the landing door lock enabling manual opening of the landing door without the use of a special key.

Attention is directed to our copending application Nos. 26742/75 (Serial No. 1 548 654) and 26741/75 (Serial No. 1 548 653).

Application 26742/75 (Serial No. 1 548 564) claims — An arrangement for operating a lift door comprising a first support element movable by an electric motor, a second support element pivoted on the first and supporting the door, means for locking the two elements together, and sensing means for initiating an alternative mode of operation of the lift door actuated

when the second support element is pivoted relative to the first support element by an amount not exceeding a predetermined limit.

Application 26741/75 (Serial No. 70 1 548 563) claims an arrangement for supporting a lift door comprising a first support element movable by an electric motor energisable from a power source, a second support element pivoted on the first and supporting the door, means for locking the two elements together, and means for automatically releasing the locking means in the event of failure of the power source whereby in the event of power failure the door may be opened manually by pivotal movement between the two elements.

The arrangement described above may be used with a normal A.C. motor without the spring return arrangement but in this case the use of a key would be necessary to unlock the landing door in the event of power supply failure.

WHAT WE CLAIM IS:—

1. A lift door operator comprising a pair of spaced apart wheels around which a chain or like band extends, the chain or band having a run extending directly between the wheels, drive means for moving the chain or band to and fro on the wheels, a driving arm for opening and closing a lift door connected thereto, the driving arm being connected at a point of attachment on said run to the chain or band, the spacing of the wheels and the movement of the chain or band being such that the point of attachment of the driving arm to the chain or band passes partially round the wheels to provide periods of acceleration and deceleration and between the wheels to provide a substantially constant velocity movement between the acceleration and deceleration periods.

2. A lift door operator as claimed in claim 1, wherein said point of attachment passes around approximately a quarter sector of the wheels.

3. A lift door operator as claimed in claim 1 or 2 wherein an endless chain is used which passes over a driving sprocket arrangement coupled to a drive motor.

4. A lift door operator as claimed in claim 3, wherein the drive means is an electric torque motor.

5. A lift door operator as claimed in any previous claim, wherein limit switches are provided at the extremities of movement.

6. A lift door operator as claimed in claim 5, wherein the limit switches are electrical and are included in the control circuit of an electrical drive motor for the door operator.

7. A lift door operator as claimed in claim 5 or 6, wherein each limit switch is operated by an actuator member pivotally

supported about the axis of the associated wheel and carried round with the wheel by the point of attachment anchorage.

8. A lift door operator as claimed in 5 claims 4 and 7, wherein the actuator member adjacent the limit switch for door closure or an extension from said member engages resilient means prior to the operation of the limit switch, at which the energisation of the motor is reduced to maintain a tension in the chain to hold the door closed.

9. A lift door operator as claimed in claim 8, wherein the actuator member is

provided with a radial extension adapted to 15 compress a spring until the actuator member or the point of attachment anchorage engages a stop, the spring being sufficiently strong to cause the point of attachment and any door connected thereto to move from 20 the fully closed position if the torque motor is completely de-energised.

10. A lift door operator substantially as herein described with reference to the accompanying drawing.

MARKS & CLERK,
Chartered Patent Agents,
Agents for the Applicants.

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COMPLETE SPECIFICATION

This drawing is a reproduction of
the Original on a reduced scale.

